

# Multiphasic Screening in a Health District Of Los Angeles

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THE NORTHEAST health district of the Los Angeles City Health Department covers about 28 square miles and contains approximately 250,000 people in its varied communities. The district health center is in Boyle Heights, where industrial encroachment has been accompanied by deterioration and devaluation of residential property. Ethnic and religious groups in Boyle Heights include newcomers from Mexico and the displaced persons camps of Europe, who arrive daily to join friends and relatives and to start life anew within the area. Ambitious young people, who have attained a degree of economic security, move out of the area.

With this community deterioration attended by problems of low income, illness, and assimilation, Boyle Heights presented a challenge to our concepts of preventive medicine and health education. The pilot multiphasic screening project was one attempt by the Los Angeles City Health Department to meet this challenge.

## Background

A local diabetes detection program was first suggested by the Eastside Community Health

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Council, whose members work or live in Boyle Heights and share a common interest in the community health. This suggestion eventuated in a multiphasic screening survey adapted by the northeast district health officer to the community's specific needs.

The Los Angeles City Health Department was familiar with multiple screening. The city's mobile X-ray unit was constructed with the intent of combining serologic tests for syphilis and X-ray examinations, and it had proved its worth in a tuberculosis-venereal disease survey in June 1950.

Coincident blood sugar determination was successfully employed with mass survey operations in Atlanta, Ga., and in Contra Costa County and San Jose, Calif. (1-4). Multiphasic screening procedures were recommended by the California Conference of Local Health Officers (2). Also, several large manufacturing concerns had requested the inclusion of diabetes detection in conjunction with the health department's X-ray and blood test screening procedures for workers.

Further, the Eastside Health Council members had gained experience with house-to-house canvassing as an effective means of promoting participation in community surveys during a previous local X-ray program.

## Planning the Survey

Our objectives were twofold. The first was case finding through early detection and referral for further study and treatment of such conditions as tuberculosis, lung cancer, certain

cardiac abnormalities, diabetes, anemia, obesity, and malnutrition.

The second objective was health education through increased community interest in prevention by periodic examination of chronic as well as acute diseases.

Four screening tests were selected: chest X-ray, blood sugar, hemoglobin, and height-weight determinations.

As a survey of the entire Boyle Heights area was a physical impossibility, operations were to be limited to 3 census tracts with an eligible population of 13,751. The population was known to have a high incidence of tuberculosis, many aged, and, according to local medical opinion, a large number of diabetics.

Based on the response of 45.8 percent of the area's eligible population to the countywide chest X-ray survey in 1950, and the known tuberculosis rate, it was estimated that approximately 6,000 persons should participate in the survey, and that 9 new cases of tuberculosis would be found. Similarly, basing our figures on the 1.4 percent high blood sugars screened in the Contra Costa survey (2), we expected to find at least 84 diabetes suspects of whom one-half would be unaware of their disease. An even higher percentage of diabetes might be discovered among relatives of the known diabetics, the obese, and the aged in this selected population.

The project was set for a 20-day period in March 1952. Twenty-eight sites within 3 blocks of every resident of the area were selected. Volunteers were assigned areas around each site for house-to-house canvassing.

The bureau of chronic diseases of the California State Department of Public Health aided in the planning, provided the district officer with invaluable consultation services, and loaned a Hewson Clinotron (A) plus some glassware.

Under direction of the bureau of medical services of the Los Angeles City Health Department, the division of tuberculosis control assigned the mobile X-ray unit and personnel to Boyle Heights for the duration of the survey, helped word the form letters on tuberculosis, and provided for rapid reading of minifilms. The coordinator of laboratory services requisitioned laboratory supplies and equipment as

needed, coordinated assignment of supplies from State and city, assigned laboratory technicians, and supervised technical laboratory procedures. The director of the nutrition division assigned a nutritionist and provided consultation to the examiners on the height-weight evaluations.

William Pote, M.D., member of the American Diabetes Association and head of the diabetic clinic at the White Memorial Hospital, accepted an appointment as diabetes consultant on followup procedures and evaluation.

### **Alerting the Public**

The Los Angeles County Tuberculosis and Health Association, cosponsors with the Eastside Community Health Council of the survey, provided campaign literature and posters as well as the part-time services of two field representatives and an experienced public health nurse.

An explanatory leaflet entitled "This Is For You" was given each pupil in the three elementary schools located in the survey area to acquaint the parents with the purpose and schedule of the survey.

East Los Angeles Junior College students reported daily for volunteer assignments. Six hours of verified volunteer work substituted for certain previously required term papers or homework in their health classes.

Churches announced the survey at services. Aliso Village Health Study Club members assumed responsibility for canvassing and registering in their public housing project, thus translating health study into positive action.

Following orientation, medical and nursing students from the College of Medical Evangelists (White Memorial Hospital) were assigned to observe and to participate in the program as part of their public health courses. In addition to their canvassing activities, many visited the unit and received the entire battery of screening tests.

The district health officer called on local practicing physicians to inform them of the survey, its purpose, schedule, followup, and referral plan. Physician response was uniformly favorable, particularly to diabetes case-finding possibilities.

The project was brought also to the attention of local hospitals, since these would undoubtedly receive referrals of suspects found in the survey.

Orientation on medical, laboratory, and control aspects of diabetes at the monthly meeting of district public health nurses featured the film "Story of Wendy Hill" (B) and a talk by our diabetes consultant. The film tells about one of the unknown diabetics and how serious the disease can become if neglected.

**Table 1. Response of selected population, northeast health district of Los Angeles**

Population and type of test	Number	Percent
Total.....	18, 831	100. 0
Total eligible <sup>1</sup> .....	13, 751	73. 0
Total tested.....	3, 203	23. 3
Chest X-ray.....	3, 203	23. 3
Blood sugar.....	2, 856	20. 8
Blood hemoglobin.....	2, 840	20. 7
Height-weight.....	2, 860	20. 8

<sup>1</sup> Over 15 years of age.

Front page publicity was obtained in the two local newspapers through press conferences with the editors and news releases submitted to them personally.

### Operations

Despite rainy weather during much of the survey, 3,203 persons, 23.3 percent of the eligible population, passed through the mobile unit at its various locations for a total of 11,759 screening tests (table 1).

In addition to the original staff consisting of unit coordinator, technician-driver, and medical investigator, the following personnel were loaned for mobile unit operations: one full-time laboratory technician from the division of laboratories, one half-time laboratory technician from the southeast health district, a part-time nutritionist from the nutrition division, and a medical investigator from the central venereal disease clinic for epidemiological case finding and followup.

When completely staffed, the mobile unit operated from 11 a. m. to 7 p. m. daily, and processed each visitor in about 5 minutes. The first step was the completion of a self-addressed post card for notification if all four tests were negative. Patients were then registered on 2 separate punchcards, 1 for tuberculosis and 1

for diabetes, hemoglobin, and height-weight screening. Two questions were asked, the second in order to decide screening levels for blood sugar determination: "Do you have diabetes?" "Have you had anything to eat or drink in the past 2 hours?"

The visitors received a chest X-ray. Next, capillary blood samples for hemoglobin and for blood sugar determination were taken. Height and weight were recorded last. An explanatory pamphlet entitled "Congratulations" was given each person before leaving.

A messenger delivered blood sugar samples to the central laboratory twice daily and returned reports.

### Screening Techniques and Findings

Minifilms (70 mm.) were read at the district health center by chest clinic physicians. Of the 3,140 persons whose films were technically satisfactory, 118, 3.8 percent, were found to be suspects; 75 were classified as possible tuberculosis; 23 as other pathology, and 20 as cardiac.

**Table 2. Screening test results, northeast health district of Los Angeles**

CHEST X-RAY			
Type of test	Number	Percent	
Total.....	3, 203	100. 0	
Unsatisfactory films.....	63	2. 0	
Total satisfactory films.....	3, 140	100. 0	
Suspects.....	118	3. 8	
Possible tuberculosis.....	75	-----	
Cardiac.....	20	-----	
Other chest pathology.....	23	-----	
Normal.....	3, 022	96. 2	
BLOOD SUGAR DETERMINATION			
Total screened.....	2, 856	100. 0	
Technically unsatisfactory results..	29	1. 0	
Total satisfactorily screened.....	2, 827	100. 0	
Screened positive.....	87	3. 1	
Previously known diabetic.....	26	-----	
Previously unknown diabetic.....	61	-----	
Screened negative.....	2, 740	96. 9	
Previously known diabetic.....	23	-----	
First screening.....	2, 717	-----	
BLOOD HEMOGLOBIN DETERMINATION			
Total.....	2, 840	100. 0	
Abnormal (low).....	233	8. 2	
Normal.....	2, 570	90. 5	
No record.....	37	1. 3	
HEIGHT-WEIGHT EVALUATION			
Total.....	2, 860	100. 0	
Overweight.....	1, 073	37. 5	
Underweight.....	90	3. 1	
Normal.....	1, 697	59. 4	

**Table 3. Confirmatory test results on suspects found in the northeast health district of Los Angeles**

CHEST X-RAY			CHEST X-RAY—Continued		
	Number	Percent		Number	Percent
Total tuberculosis suspects.....	75	100.0	Previously unknown to health department.....	18	-----
Patients notified.....	75	100.0	Total cardiac suspects.....	20	-----
Patients reporting.....	64	85.3	Patients notified to seek other diagnostic facility.....	20	-----
Patients reporting.....	64	100.0	Patients reporting to city health department.....	3	-----
Minimal.....	23	-----	BLOOD SUGAR RECHECK		
Active.....	2	-----	Total diabetes suspects.....	87	-----
Inactive.....	19	-----	Patients notified.....	87	100.0
Arrested.....	2	-----	Patients reporting.....	76	87.4
Moderately advanced.....	6	-----	Number tests done.....	72	82.7
Active.....	4	-----	Previously unknown positives retested.....	55	-----
Activity undetermined.....	2	-----	Retested positive (fasting and 2 hours post sugar ingestion).....	16	-----
Far advanced.....	1	-----	Retested positive (2 hours post sugar); negative (fasting).....	16	-----
Inactive.....	1	-----	Retested negative (fasting and 2 hours post sugar).....	23	-----
Other tuberculosis.....	1	-----	Previously known positives retested.....	17	-----
Primary, healed.....	1	-----	Retested positive (fasting only).....	10	-----
Other chest pathology.....	6	-----	Retested negative or under control (fasting only done).....	6	-----
Diagnosis unknown.....	8	-----	Retested technically unsatisfactory.....	1	-----
Deferred diagnosis.....	2	-----	HEMOGLOBIN RECHECK		
Under care, private physician.....	5	-----	Total low hemoglobin suspects.....	233	-----
Under care, central chest clinic.....	1	-----	Patients notified.....	224	-----
Essentially negative.....	19	-----	Patients reporting.....	142	63.4
Previously known to health department.....	8	-----	Abnormal (Sahli 11.2 gm. or 68.75 percent or below).....	30	21.1
Minimal inactive.....	4	-----	Normal.....	112	78.9
Minimal arrested.....	2	-----	HEIGHT-WEIGHT DETERMINATION		
Moderately advanced, active.....	1	-----	Total (overweight and underweight).....	1,163	-----
Other chest pathology.....	1	-----	Patients notified.....	1,163	-----
Previously unknown to health department.....	56	-----	Patients reporting.....	192	16.5
Total other chest pathology suspects.....	23	100.0			
Patients notified.....	23	100.0			
Patients reporting.....	18	78.3			
Patients reporting.....	18	100.0			
Other pathology (bronchiectasis, possible cancer, emphysema, pleurisy, etc.).....	5	-----			
Diagnosis unknown.....	2	-----			
Under care private physician.....	2	-----			
Essentially negative.....	11	-----			

Three thousand and twenty-two persons, 96.2 percent, were found essentially normal. The films for 63, 2 percent of the 3,203 persons screened, were technically unsatisfactory (table 2).

Blood sugar specimens were screened by Clin-itron (A) at 130 and 180 mg. percent glucose, depending on recency of food ingestion. Of 2,827 persons with satisfactory tests, including 49 previously known diabetics, 87, 3.1 percent, had abnormally high blood sugar levels. Of these 87, 26, approximately 30 percent, were previously known diabetics.

Blood hemoglobin determination was done on the spot using the copper sulfate specific

gravity test with screening levels at 11.0 gm. and 12.3 gm. per 100 ml. of blood for females and males, respectively. Of the 2,840 persons tested, 233, 8.2 percent, had hemoglobin concentrations below the screening level selected.

Height-weight measurements were featured to spotlight obesity as a public health problem, particularly as related to diabetes. Of 2,860 persons evaluated on the basis of optimum weight for height and body build (according to Metropolitan Life Insurance Company tables), 1,073, 37.5 percent, were classified as 10 percent or more overweight and 90, 3.1 percent, were classified as 10 percent or more underweight.

## Followup

Results of these screening procedures were tabulated daily. Notification of those entirely negative began before the conclusion of survey operations. Scheduling appointments to the retake clinics at the health center for secondary screening of those with abnormalities occupied the full time of a medical investigator and frequently completely bogged down the normal functioning of our clerical staff.

### Response and Results

Chest X-ray recheck, using 14-inch by 17-inch film, plus further diagnostic procedures when indicated, followed routines already in operation, with resultant temporary overloading of our crowded tuberculosis clinics.

Sixty-four, 85.3 percent, of the tuberculosis suspects notified, reported for recheck. Tuberculosis was diagnosed in 30, 46.9 percent, of whom 6 were classified as active, 20 as inactive, 2 as arrested, and 2 as activity undetermined. Five of those designated as active were not aware of this condition and were previously unknown to the health department. The sixth was returned to medical supervision. Essentially negative diagnoses were made in 19 cases (table 3).

Eighteen, 78.3 percent, of the persons with other chest pathology reported to our clinics for further workup. Five were found to have such conditions as bronchiectasis, emphysema, pleurisy, and possible cancer.

Those 20 persons in whom a possible cardiovascular abnormality was noted were referred by letter to their private physician or clinic for further study.

The 63 persons whose films were found technically unsatisfactory were referred to the nearest clinic or mobile unit for another film.

Confirmatory blood sugar tolerance tests in fasting state and 2 hours after controlled carbohydrate intake were run on 72, 82.7 percent, of those found to have high blood sugar on previous screening. Of the 55 previously unknown as diabetics, 16 were found to have abnormal blood sugar metabolism and an additional 16 were classified as borderline or potential diabetics. Twenty-three, or about one-third, had normal blood sugar levels (table 3).

**Table 4. Referral and followup results of screening of diabetics in northeast health district of Los Angeles**

	Number	Percent
Confirmed high blood sugar referred to private physician or clinic for diagnosis.....	42	1.5
Diagnosis reported by physician or clinic.....	31	1.1
Previously unknown diabetic:		
Not diabetic.....	4	-----
Clinic.....	1	-----
Private physician.....	3	-----
Is a diabetic.....	16	-----
Clinic.....	10	-----
Private physician.....	6	-----
Diagnosis established prior to this survey by private physician.....	3	-----
Record incomplete (as of Sept. 22, 1952).....	9	-----
Total.....	32	-----
Previously known diabetic:		
Had lapsed from regular medical care and made at least one visit to the clinic as a result of the survey.....	3	-----
Has been following medical advice for the control of diabetes with reasonable regularity.....	5	-----
Clinic.....	2	-----
Private physician.....	3	-----
Record incomplete (as of Sept. 22, 1952).....	2	-----
Total.....	10	-----

### SUMMARY

Total cases diabetes diagnosed.....	27	1.0
Previously unknown diabetics.....	16	.6
Previously known diabetics.....	11	.4
Under care of clinics.....	15	-----
Under care of private physicians.....	12	-----
Record incomplete.....	11	-----

Among the 17 previously known diabetics whose blood sugar was rechecked after fasting, 10 were apparently inadequately controlled, 6 were probably under control, and 1 test was technically unsatisfactory. During the 2 hours after controlled carbohydrate intake, our district nutritionist led a group discussion on obesity and diabetes, a film (C) was shown, and questionnaires concerning diabetes were distributed and discussed.

The hemoglobin recheck clinics were attended by 142 patients, or 63.4 percent of those notified. Approximately one-fifth were found to have hemoglobins below 68.75 percent, or 11.2 gm. Sahli (table 3). A nutritionist was available for consultation with the patients.

Overweight persons were invited to a showing and discussion by the nutritionist of the film

"Cheers for Chubby" in order to motivate them to seek a change in diet pattern. Only 192, 16.5 percent, responded (table 3). Those found underweight were also given the opportunity for consultation with our nutritionist.

### Referrals

Referrals of those diagnosed as tuberculosis and other chest pathology followed established health department policy.

The 42 diabetes suspects, after second screening, were referred to physicians or clinics of their choice for further study. Form letters containing laboratory results were sent the respective physicians or clinics, and a report of the final diagnosis was requested.

When no report was forthcoming, our public health nurses made home calls to encourage patient followup in some cases. In others, physicians were contacted by phone.

Those with low hemoglobin on recheck were given a referral to the physician or clinic of their choice. Those with weight discrepancies were urged to check with their family doctors or clinics. A series of group weight control sessions with a nutritionist leader and medical social worker is under consideration for overweight persons who obtain medical recommendation.

### Evaluation

As a health education measure, the program utilized and extended the residual community enthusiasm and knowledge from previous tuberculosis surveys. Similar results may confidently be expected in the future. We already have received requests for this type of survey from other sections of the community.

Furthermore, physicians, medical schools, clinics, public schools, and churches in the area have been alerted to the public health significance of diabetes and obesity and to this relatively new method of case finding cosponsored by health department, health council, and tuberculosis association. Our followup with physicians as regards diagnostic criteria was inadequate, chiefly because we relied on individual rather than group contact.

Although only half as many people responded

as we had anticipated, reports to date from clinics and private doctors indicate that the survey may be credited with:

Six newly diagnosed cases of active tuberculosis (1.8 per 1,000 participants); 5 newly diagnosed "other pathology" such as emphysema, bronchiectasis, pleurisy; 16 newly diagnosed diabetics (6 per 1,000); 3 previously known diabetics returned to treatment; and 30 persons with abnormally low hemoglobins referred to clinic or private care (11 per 1,000); 1,073 (37.5 percent) obese individuals informed as to significance of this condition; and 90 (3.1 percent) underweight persons advised to seek further examination.

At first glance, mass survey methods appear costly. However, in contrast to the pyramiding cost of hospitalization, often at public expense, and rehabilitation plus financial aid to dependents, the economies of screening become apparent if preventive or corrective action ensues.

Personnel was insufficient. All concerned worked to the limit of their capacities. Illness, sharing of staff with other projects, and personal business—all took their toll. Staff members frequently went without meals because no substitutes were available. Occasionally, people grew discouraged when the waiting line became too long and left without completing the entire battery of tests.

We now realize that two full-time laboratory technicians were essential. A dry run should have been held to check on operations and permit the laboratory technicians to develop speed and accuracy. One full-time person should be responsible for volunteer relationships and another for recordkeeping and notification. Extra clerical help must be included in mass survey plans.

Morning hours were not practical, whereas late afternoon and evening hours yielded the best results.

### Conclusion

Health agencies, private physicians, and public alike are giving increased attention to early detection as the basic long-range approach to the chronic disease problem. Although cost studies have not been completed—based on the experience gained from this pilot cooperative

effort in the northeast health district—adequately planned, short-term, intensive multiphasic surveys in selected high-incidence census tracts or limited areas should be encouraged as effective health education and case-finding tools.

#### REFERENCES

- (1) Petrie, L. M., Bowdoin, C. D., McLoughlin, C. J.: Voluntary multiple health tests. *J.A.M.A.* 148: 1022-1024 (1952).
- (2) Milmore, B. K.: Diabetes control activities in California. *California's Health* 9: 57-60 (1951).
- (3) Breslow, L.: Recent developments in multiphasic screening. *California's Health* 8: 89-90 (Dec. 1950).
- (4) Milmore, B. K.: The problem of diabetes. *California's Health* 7: 41-43 (Sept. 1949).

#### EQUIPMENT REFERENCES

- (A) Hewson Clinitron, Mathewson Machine Works, Inc., Quincy, Mass.
- (B) *The Story of Wendy Hill*. Sound, color, 16 mm., 20 minutes, 1949. Available through the California State Department of Public Health and the American Diabetes Association. For high school, college, adult, and training groups. Cleared for television.
- (C) *Cheers for Chubby*. Sound, color, animated, 16 mm., 8 minutes, 1951. Produced by the Metropolitan Life Insurance Co. in cooperation with the Public Health Service and the American Medical Association. Available through the Metropolitan Life Insurance Co. For high school, college, and adult groups and also for professional personnel.

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## Applications for Research Awards

Applications for research awards to be made for periods beginning July 1, 1955, by the American Heart Association and its affiliates are now being accepted. Applications for research fellowships and established investigatorships may be filed up to September 15, 1954. Applications for research grants-in-aid will be accepted up to December 1, 1954.

Established investigatorships, awarded for 1- to 5-year periods subject to annual review, range from \$6,000 to \$9,000. They are available to scientists of proved ability who are engaged in a research career. Research fellowships, awarded for 1- to 2-year periods, range from \$3,500 to \$5,500 and enable scientists to train for research careers under experienced supervision. Grants-in-aid are awarded in varying amounts, usually not exceeding \$10,000, for periods of 1 to 3 years, to experienced scientists working in nonprofit institutions on specified programs of research.

Additional information and application forms may be obtained from: Medical Director, American Heart Association, 44 East 23d Street, New York 10, N. Y.